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IS 15382 (Part 2/Sec 1) : 2003
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(Superseding SP 39 : 1987)

भारतीय मानक

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भाग 2 अनुप्रयोग मार्गदर्शिका

खंड 1 आयाम देने की कार्यविधि कार्यशीट और आयाम के उदाहरण

Indian Standard

INSULATION COORDINATION FOR EQUIPMENT WITHIN LOW-VOLTAGE SYSTEMS

PART 2 APPLICATION GUIDE

Section 1 Dimensioning Procedure Worksheets and Dimensioning Examples

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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Price Group 4

High Voltage Engineering Sectional Committee, ET 19

NATIONAL FOREWORD

This Indian Standard (Part 2/Sec 1) which is identical with IEC 60664-2-1 (1997) 'Insulation coordination for equipment within low-voltage systems — Part 2-1: Application guide — Dimensioning procedure worksheets and dimensioning examples' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendations of the High Voltage Engineering Sectional Committee and approval of the Electrotechnical Division Council.

This standard was first published in 1987 as SP 39 'Special publication — Guide for insulation coordination within low voltage systems'. The revision of this standard was felt necessary with a view to align this standard with international practices.

This standard consists of the following parts under the general title 'Insulation coordination for equipment within low voltage systems':

Part 1	Principles, requirements and tests
Part 2	Application guide, Section 1 Dimensioning procedure worksheets and dimensioning examples
Part 3	Use of coatings to achieve insulation coordination of printed board assemblies
Part 4	Consideration of high frequency voltage stress

This standard is to be read in conjunction with Part 1 of this standard.

The text of the IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'; and

b) Comma (,) has been used as a decimal marker, while in Indian Standards the current practice is to use a point (.) as the decimal marker.

With the publication of this standard SP 39 shall be withdrawn.

Only the English text of the International Standard has been retained while adopting it as an Indian Standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding of numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

IS 15382 (Part 2/Sec 1) : 2003
IEC 60664-2-1 (1997)

Indian Standard

INSULATION COORDINATION FOR EQUIPMENT WITHIN LOW-VOLTAGE SYSTEMS

PART 2 APPLICATION GUIDE

Section 1 Dimensioning Procedure Worksheets and Dimensioning Examples

1 Scope

This technical report is intended as a guide for technical committees specifying dimensioning requirements for products in accordance with IEC 60664-1.

The significant items for consideration are as follows:

a) nominal system voltage(s) or rated insulation voltage(s);

b) overvoltage category of the products;

c) pollution degree.

A diagram for dimensioning of clearances and creepage distances for low-voltage equipment (up to 2 000 m) is shown in figure 1.

All references given below are to IEC 60664-1.

2 Clearances

Clearances are dimensioned to withstand the required impulse withstand voltage either:

- by requiring dimensions of not less than case A values, or
- by requiring verification by an impulse test.

For equipment directly connected to the supply mains the required impulse withstand voltage is the rated impulse voltage established on the basis of 2.2.2.2. If steady-state r.m.s. voltage, recurring peak voltage or temporary overvoltage require larger clearances than required for the impulse withstand voltage, the corresponding values of the column with peak values for a.c. (50/60 Hz) in table A.1 are appropriate.

Clearances of basic and supplementary insulation are each dimensioned as specified in table 2 corresponding to:

- the rated impulse voltage, according to 2.2.2.2 or 2.2.2.3.1, or
- the impulse withstand voltage requirements according to 2.2.2.3.2.

Clearances of reinforced insulation are dimensioned as specified in table 2 corresponding to the rated impulse voltage but one step higher in the preferred series of values in 2.1.1.2 than that specified for basic insulation.

If the impulse withstand voltage required for basic insulation according to 2.2.2.3.2 is other than a value taken from the preferred series, reinforced insulation is dimensioned to withstand 160 % of the impulse withstand voltage required for basic insulation.

NOTE – When dimensioning clearances to accessible surfaces of insulating material, such surfaces are assumed to be covered by metal foil. Further details can be specified by technical committees.

3 Creepage distances

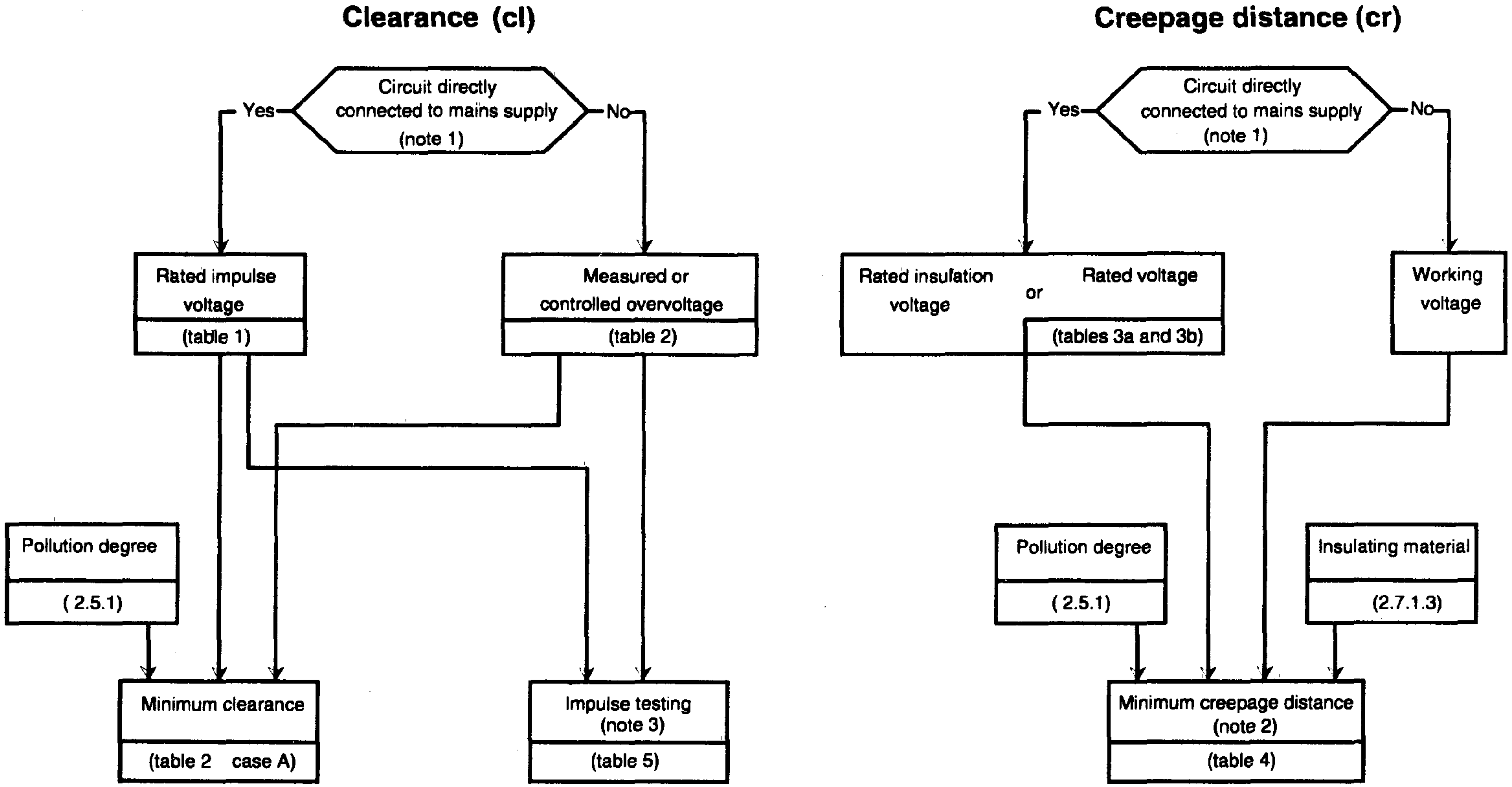
The creepage distances shown in table 4 have been determined for insulation intended to be under continuous voltage stress for a long time. Technical committees responsible for equipment in which insulation is under voltage stress for only a short time may consider allowing reduced creepage distances than those specified in table 4.

Creepage distances of basic and supplementary insulation are selected from table 4 for:

- the rationalized voltages (see 2.2.1.1) given in columns 2 and 3 of table 3a and columns 2, 3 and 4 of table 3b, corresponding to the nominal voltage of the supply low-voltage mains;
- the rated insulation voltage according to 2.2.1.1.1;
- the voltage specified in 2.2.1.1.2.

NOTE – For supplementary insulation, the pollution degree, insulating material, mechanical stresses and environmental conditions of use may be different from those for basic insulation.

Reinforced insulation is dimensioned as specified in table 4 corresponding to twice the value of the voltage specified for basic insulation.



NOTES

1 Includes all circuits significantly affected by external transient overvoltages.

2 Where the minimum creepage distance from table 4 is less than the case A clearance value from table 2 the following applies:

a) For pollution degrees 3 and 4 the minimum spacing across the insulating material surface is equal to the clearance value.

b) For pollution degrees 1 and 2 the spacing across the insulating material surface is permitted to be the minimum creepage distance provided the spacing withstands the relevant impulse test according to the clearance requirement.

3 Subject to the minimum values of clearance given in table 2 for case B.

Figure 1 – Diagram for dimensioning of clearances and creepage distances for low-voltage equipment (up to 2 000 m)
(references to IEC 60664-1)

4 Examples of a dimensioning worksheet (based on case A)

(Basic insulation for equipment used up to 2 000 m)

4.1 For circuits in equipment connected to the mains supply

Influencing parameters	**Basis of selection**	**IEC 60664-1 reference**	**Value**
	Clearance		
Voltage or rated insulation voltage	Overvoltage category of equipment	Table 1	Table 2
	Creepage distance		
Voltage	Rated voltage or rated insulation voltage	Tables 3a and 3b	Table 4
Pollution	Pollution degree (micro-environment)	Subclause 2.5.1	Table 4
Insulating material	Comparative tracking index	Subclause 2.7.1.3	Table 4

Step 1 – Select overvoltage category

Step 2 – Select impulse voltage (table 1)

Step 3 – Establish minimum clearance (cl) value (table 2)

Step 4 – Select rated voltage for creepage distance (tables 3a and 3b)

Step 5 – Establish pollution degree and comparative tracking index (CTI)

Step 6 – Establish minimum creepage distance (cr) value (table 4)

Step 7 – Where cr < cl:

- if pollution degree is either 3 or 4, spacing on insulating material meets cl value;
- if pollution degree is either 1 or 2, spacing on insulating material may be cr value if the spacing withstands the impulse withstand voltage used to establish the clearance.

4.2 For circuits not connected to the mains supply; specially protected so as not to be subject to the full value of mains circuit overvoltages

Influencing parameters	**Basis of selection**	**IEC 60664-1 reference**	**Value**
	Clearance		
Impulse withstand voltage	Measured or controlled overvoltage	—	Table 2
	Creepage distance		
Voltage across insulating material	RMS voltage	—	Table 4
Pollution	Pollution degree (micro-environment)	Subclause 2.5.1	Table 4
Insulating material	Comparative tracking index	Subclause 2.7.1.3	Table 4

Step 1 – Select overvoltage

Step 2 – Establish minimum clearance (cl) value (table 2)

Step 3 – Select r.m.s. voltage for creepage distance

Step 4 – Establish pollution degree and comparative tracking index (CTI)

Step 5 – Establish minimum creepage distance (cr) value (table 4)

Step 6 – Where cr < cl:

- — if pollution degree is either 3 or 4, spacing on insulating material meets cl value;
- — if pollution degree is either 1 or 2, spacing on insulating material may be cr value if the spacing withstands the impulse withstand voltage used to establish the clearance.

5 Dimensioning examples (based on case A)
(basic insulation for equipment used up to 2 000 m)

5.1 Product No. 1

Energy consuming equipment, rated 230 V, single phase.

NOTE – Household and office energy consuming equipment is commonly considered to be in overvoltage category II.

5.1.1 Circuits connected to mains supply

		Clearance	
Rated impulse voltage	2 500 V	Clearance	1,5 mm
		Creepage distance	
Rated voltage	230 V	Creepage distance	2,5 mm
Pollution degree	2		
Insulating material	CTI GR III		

5.1.2 Protected electronic circuits (overvoltage category I)

		Clearance	
Highest impulse voltage expected to occur	1 500 V	Clearance	0,5 mm
		Creepage distance	
Working voltage	230 V	Creepage distance	0,56 mm
Pollution degree	1		
Insulating material	CTI GR I		

5.1.3 Other circuits not connected to mains supply

		Clearance		
Highest impulse voltage expected to occur	2 200 V	Clearance	1,2 mm	
		Creepage distance		
Working voltage	120 V	Creepage distance	0,16 mm	on printed wiring material
			or 0,28 mm	for other construction
Pollution degree	1			
Insulating material	CTI GR II			

NOTE – At locations where clearance and creepage distances cannot be differentiated (e.g. on printed wiring material) the larger distance is used, therefore:

- for 5.1.1 above, the minimum clearance and creepage distance would be 2,5 mm;
- for 5.1.2 above, the minimum clearance and creepage distance would be 0,56 mm;
- for 5.1.3 above, the minimum clearance and creepage distance would be 1,2 mm.

5.2 Product No. 2

Industrial motor controller, rated 230 / 400 V, three phase.

NOTE – Industrial products are normally considered to be overvoltage category III products.

5.2.1 Circuits connected to mains supply

Clearance

Rated impulse voltage	4 000 V	Clearance	3,0 mm

Creepage distance

Rated voltage	400 V, line-line	Creepage distance	5,6 mm
	230 V, line-neutral	Creepage distance	3,6 mm
Pollution degree	3		
Insulating material	CTI GR II		

5.2.2 Protected electronic circuits (overvoltage category I)

Clearance

Highest impulse voltage expected to occur	1 500 V	Clearance	0,5 mm

Creepage distance

Working voltage	190 V	Creepage distance	0,42 mm
Pollution degree	1		
Insulating material	CTI GR III		

5.2.3 Other circuits not connected to mains supply

Clearance

Highest impulse voltage expected to occur	3 500 V	Clearance	2,5 mm	

Creepage distance

Working voltage	500 V	Creepage distance	2,5 mm	on printed wiring material
			or	
			5,0 mm	for other construction
Pollution degree	2			
Insulating material	CTI GR III			

NOTE – At locations where clearance and creepage distances cannot be differentiated (e.g. on printed wiring material) the larger distance is used, therefore:

- for 5.2.1 above, the minimum clearance and creepage distance would be 5,6 mm and 3,6 mm, for 400 V and 230 V, respectively;

- for 5.2.2 above, the minimum clearance and creepage distance would be 0,5 mm unless the distance withstands a 1 500 V impulse test, in which case a distance of 0,42 mm could be used (see 3.2.1.5);

- for 5.2.3 above, the minimum clearance and creepage distance would be 2,5 mm on printed wiring material or 5,0 mm for other constructions.

5.3 Product No. 3

Equipment for fixed installations, rated 230 V, single phase.

NOTE – Equipment for fixed installation is normally considered to be an overvoltage category III product.

5.3.1 Device connected to mains supply

	Clearance		
Rated impulse voltage	4 000 V	Clearance	3,0 mm
	Creepage distance		
Rated voltage	230 V	Creepage distance	2,5 mm
Pollution degree	2		
Insulating material	CTI GR III		

NOTE – At locations where clearance and creepage distances cannot be differentiated (e.g. on printed wiring material) the larger distance is used, therefore the minimum clearance and creepage distance would be 3,0 mm.

6 Reference document

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

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